

# Spectral Data Acquisition for the Nearby Supernova Factory

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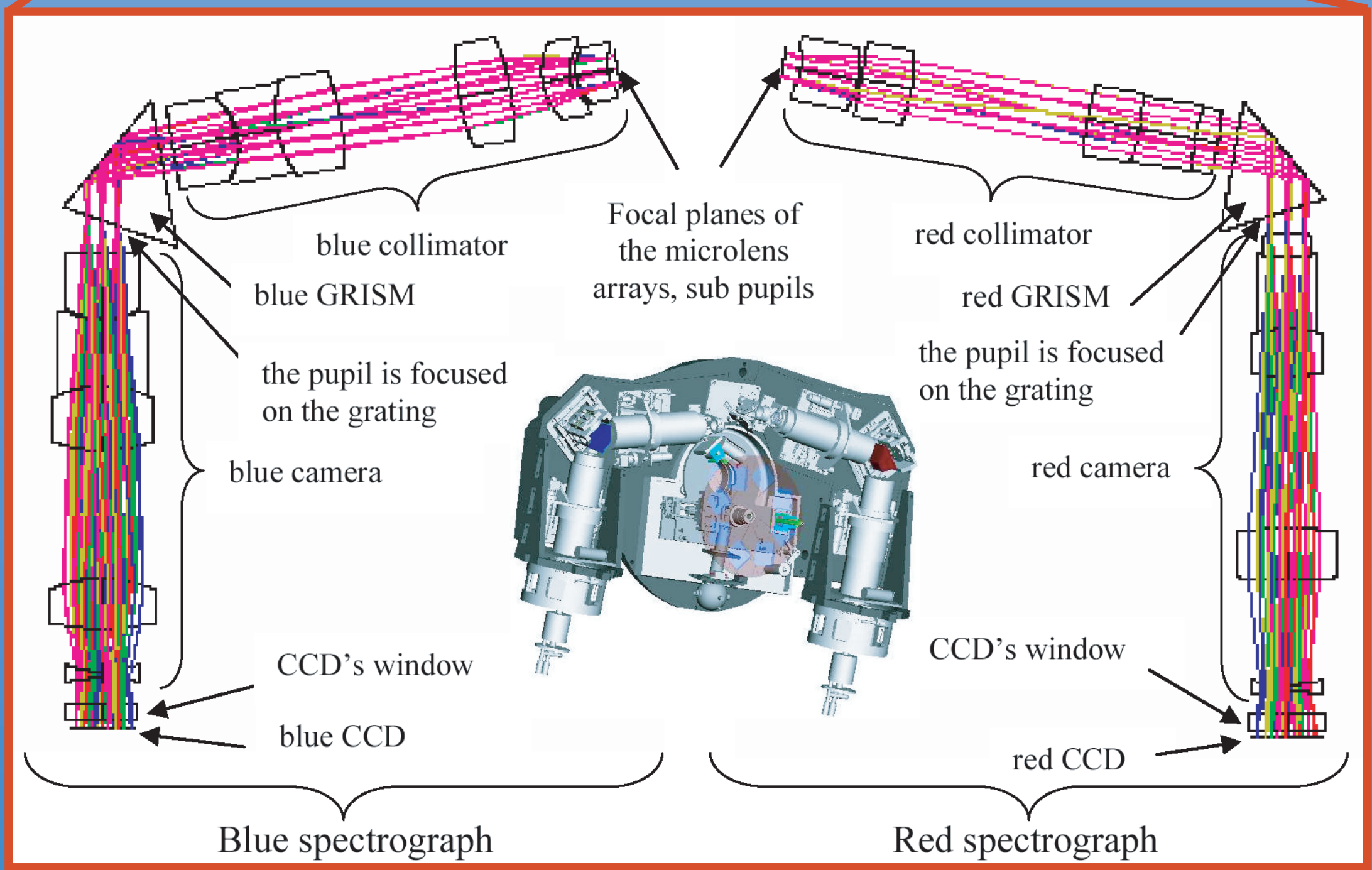
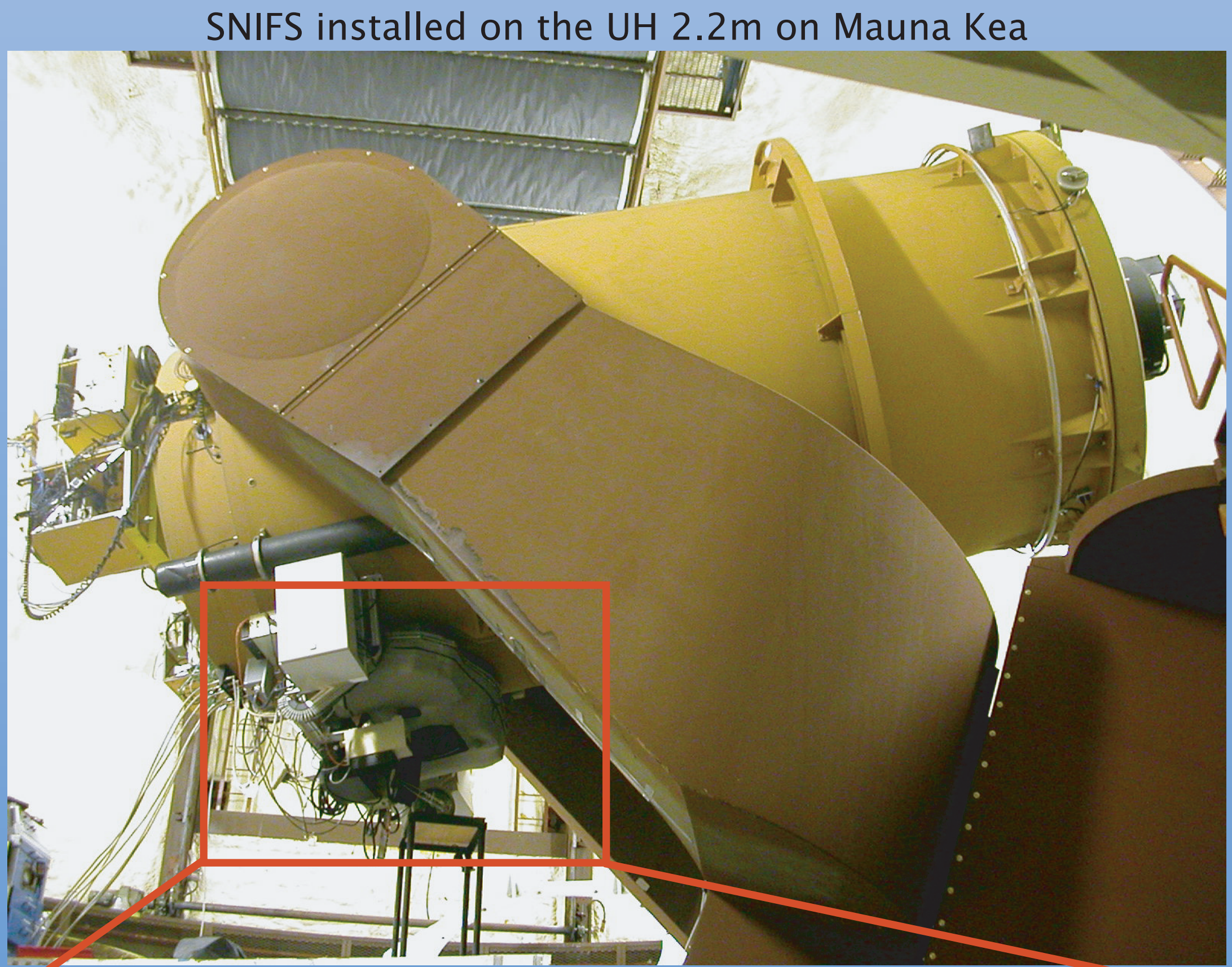


(artist's concept)

The Nearby Supernova Factory (SNfactory) is a project to discover and study a large sample of type Ia supernovae (SNe Ia) in the redshift range  $0.03 < z < 0.08$ . The SNfactory will obtain a uniform high-quality dataset of flux-calibrated optical spectra at 10–15 epochs, every few days starting 5–15 days before maximum light, for each SNe Ia. Supernova candidates are found by searching wide-field imaging data from the Near Earth Asteroid Tracking (NEAT) project at JPL, and from the Palomar Consortium (Yale/JPL/Caltech) (see Scalzo et al. poster 171.03). Follow-up observations are performed with the Supernova Integral Field Spectrograph (SNIFS), a novel instrument optimized for SNe studies, installed on the University of Hawaii 2.2-meter telescope on Mauna Kea. The SNIFS integral field spectroscopy addresses the vexing problem of separating SN and host galaxy spectra, while the spectrophotometric data can be used to simultaneously study the evolution of SN spectral features and synthesize SN light curves for any filter in the broad 320–1000 nm bandpass (UBVRI, ugriz, etc.). The SNfactory dataset will thus dramatically improve our understanding of the physics of SNe Ia and reduce the uncertainties in their use as cosmological standard candles. SNIFS observations have been conducted remotely from the United States and France since June 2004, with increasing emphasis on scripting and automation for greater efficiency. This poster will review the current state of SNfactory spectroscopic data acquisition and remote observing operations.

## SNIFS on the UH 2.2m:

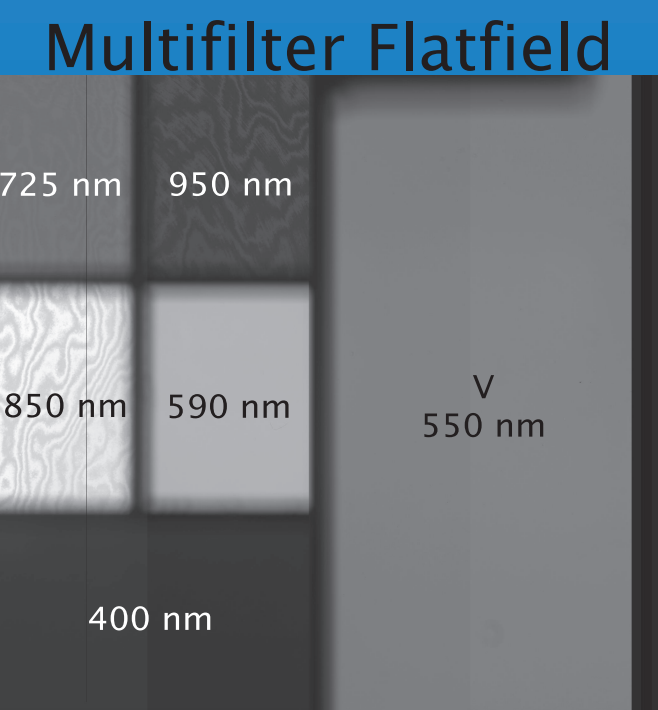
In order to obtain spectrophotometric observations of many SNe Ia, the SNfactory constructed the SuperNova Integral Field Spectrograph (SNIFS), which was installed on the UH 2.2-m telescope on Mauna Kea in April 2004. At present 20% of all observing time on the UH 2.2-m is devoted to observing supernovae with SNIFS. The instrument features a dual-channel optical spectrograph and a two CCD imaging/guiding camera.



Spectrograph Optics Layout  
SuperNova Integral Field Spectrograph

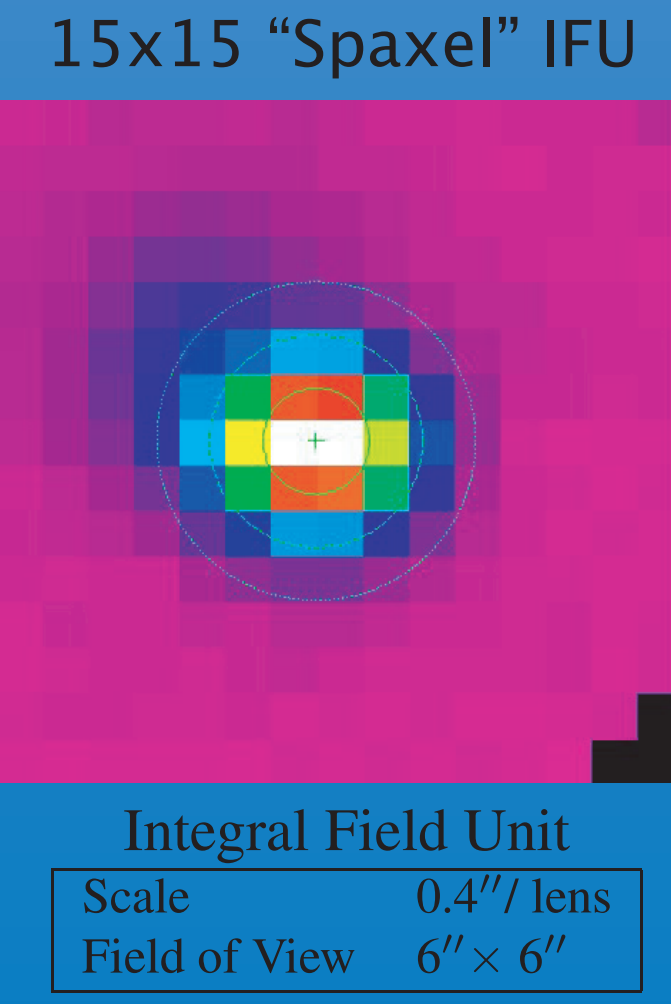
Each spectrographic channel exploits a 15x15 microlens array to image 225 spectra across the 6"x6" field of view.

	Spectrograph	
Channel	Blue	Red
Coverage	3500-5500 Å	5500-10000 Å
Spectral Resolution	2.3 Å	3.3 Å
Grism	300 l/mm ( $\lambda_D = 4200$ Å)	300 l/mm ( $\lambda_D = 6500$ Å)
Detector	Marconi 2k x 4k	E2V-DD 2k x 4k
Calibration	He/Hg/Cd + flat	Ne/Ar/Xe + flat

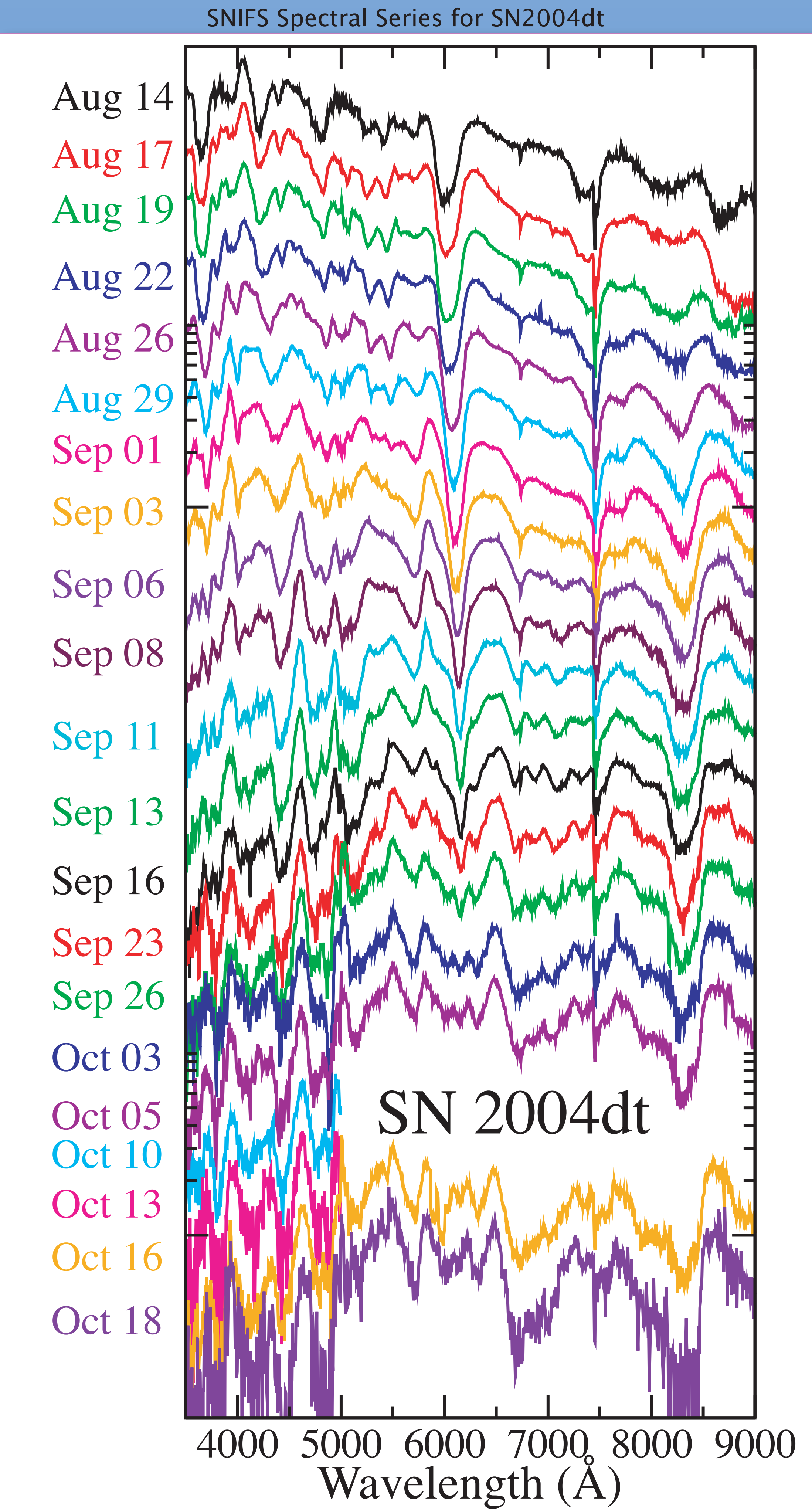
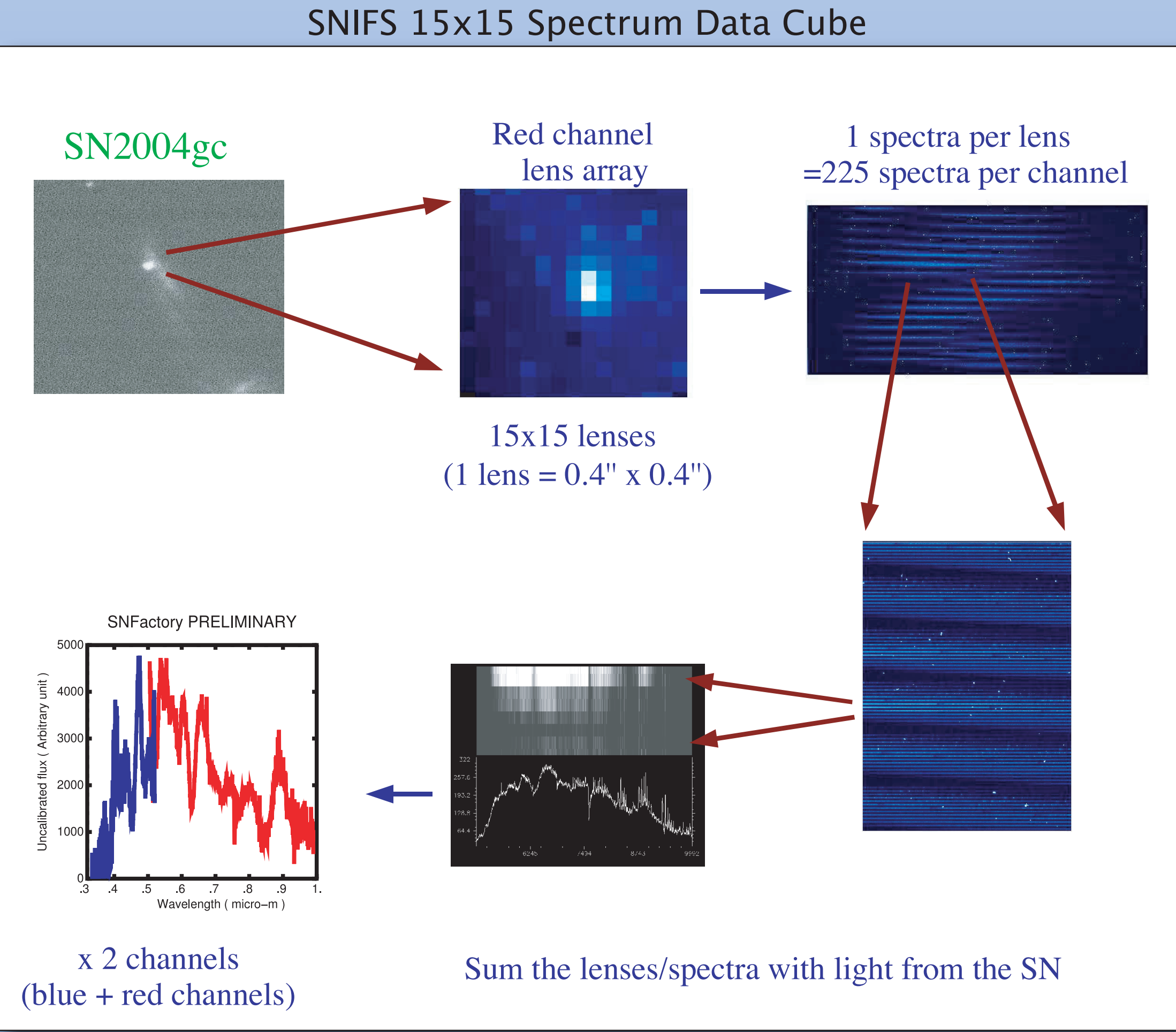


Guider/Focuser Camera (Fixed)	
Scale	0.14"/pixel
Field of View	4.7' x 9.4'
Detector	E2V 2k x 4k
Filters	none

Auxiliary Camera	
Scale	0.14"/pixel
Field of View	4.7' x 9.4'
Detector	E2V 2k x 4k
Filters	UBVRIZ + extinction monitor

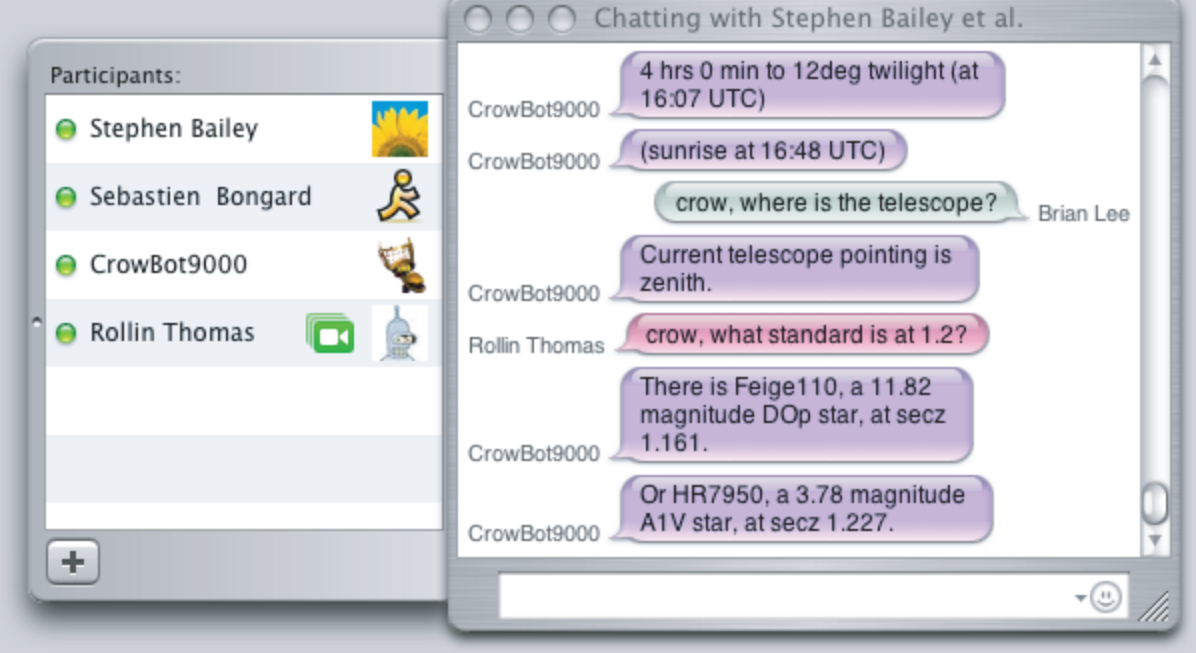
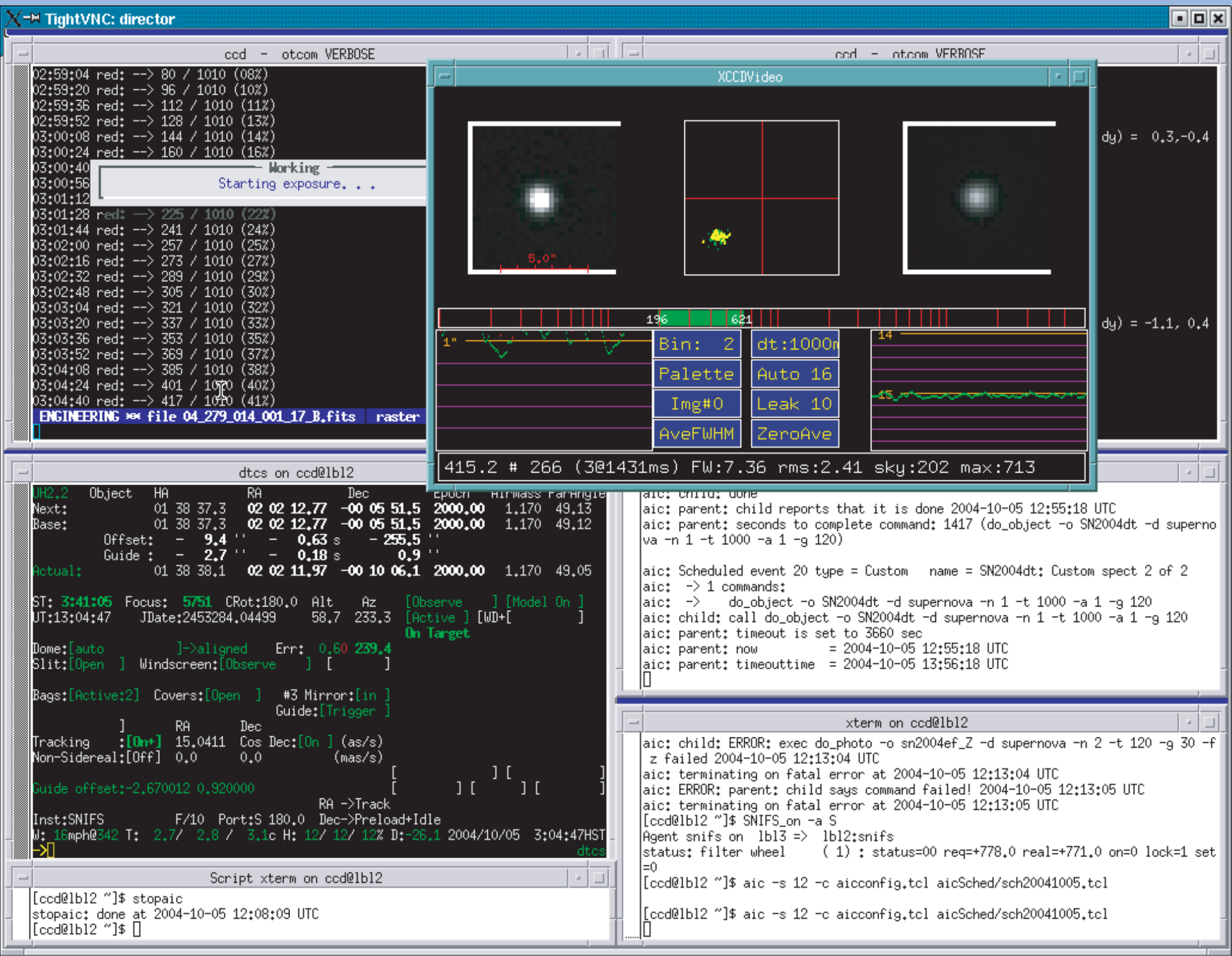


During each spectroscopic exposure, the imaging camera makes multi-band photometric observations of stars in an adjacent field using custom-designed filters. By comparing the observed brightnesses of these stars to the brightnesses observed on a photometric night, the corresponding supernova spectrum can be corrected for atmospheric extinction even on non-photometric nights.



## Remote Operation:

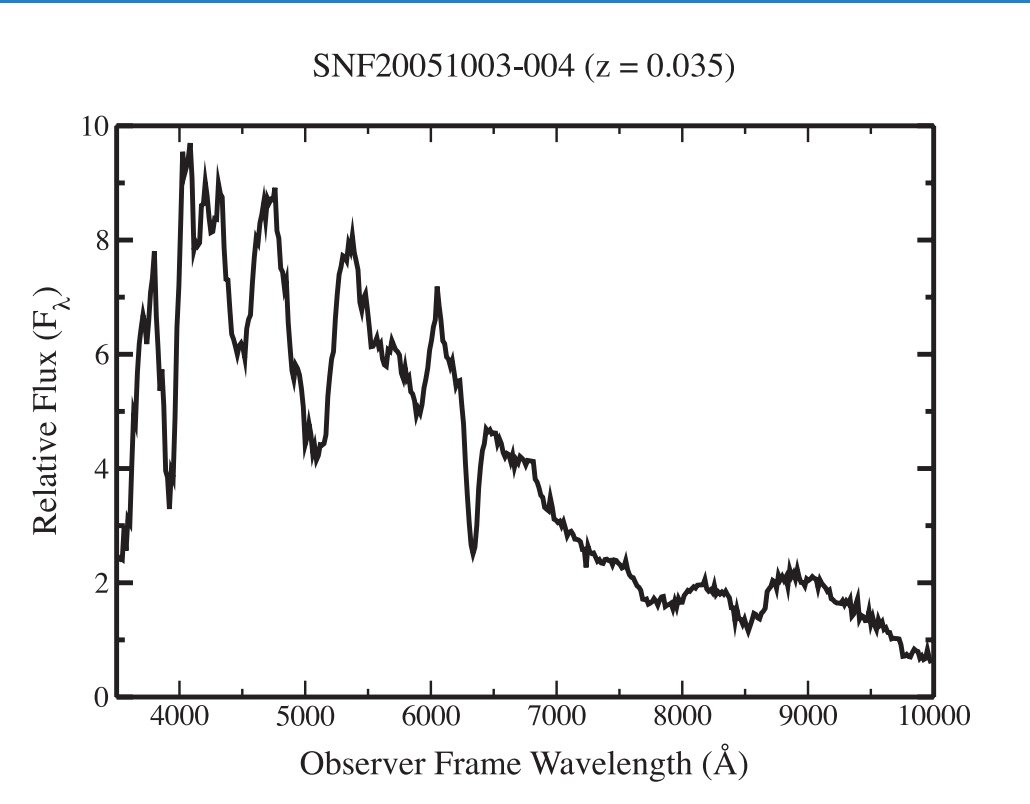
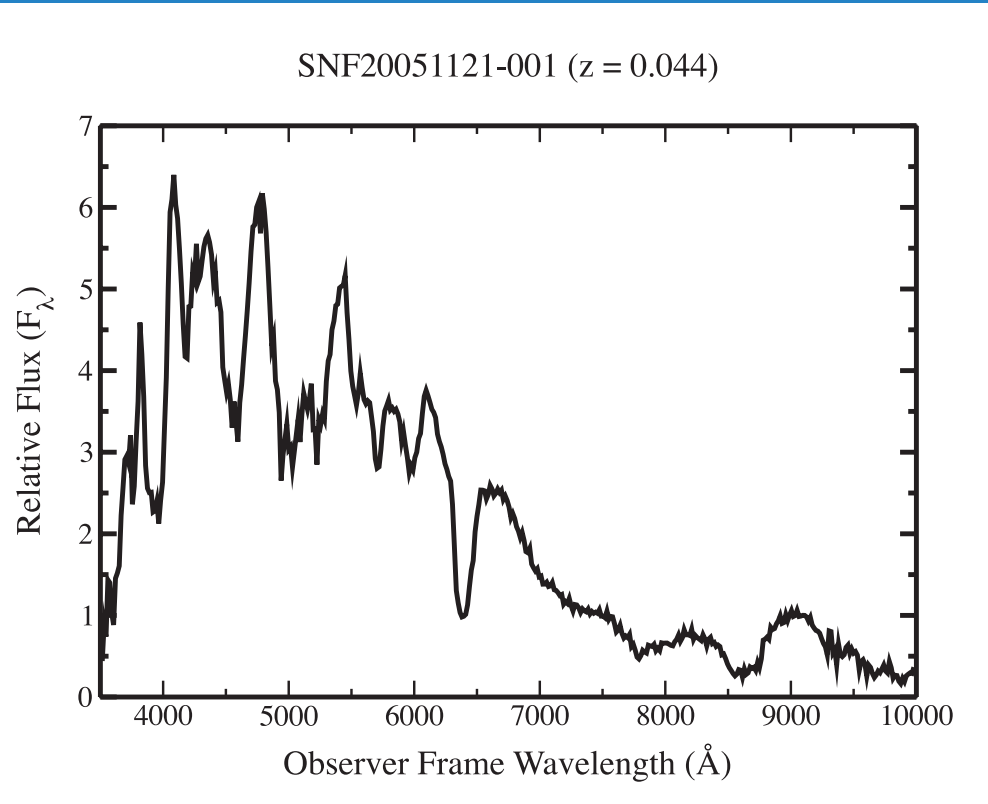
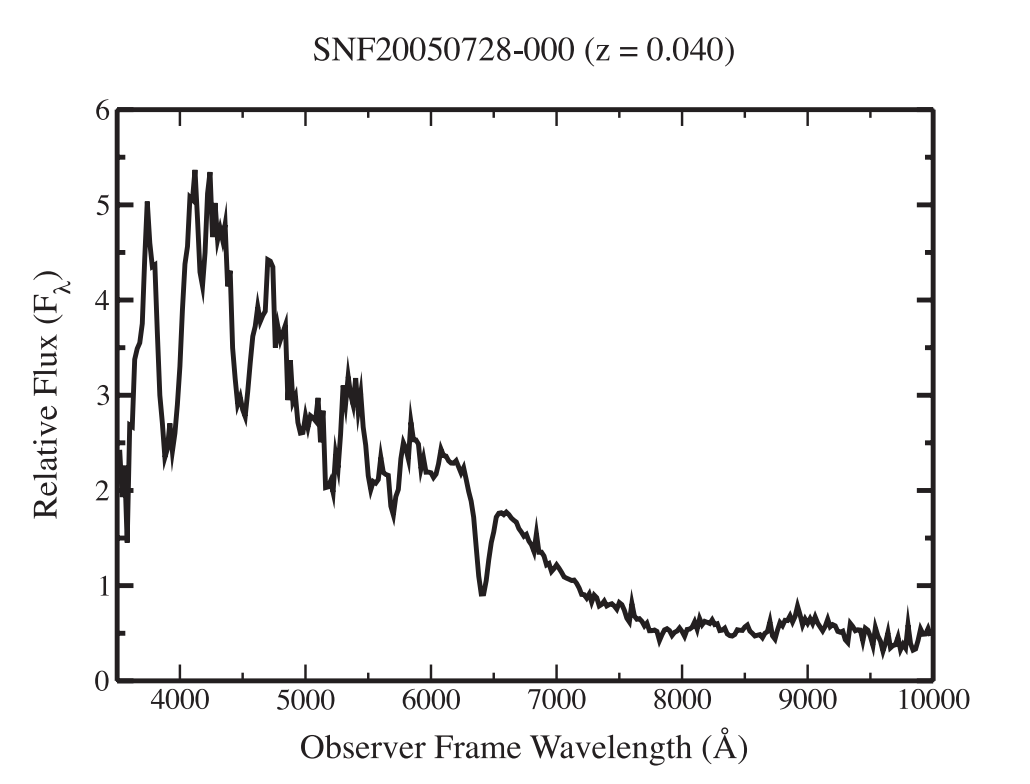
The UH 2.2m telescope and SNIFS are operated remotely over the Internet, with the UH telescope operator (TO) at sea level in Hilo and the SNIFS operator typically in France or California. SNfactory software controls all aspects of observations, from moving and guiding the telescope to acquiring spectra. SNfactory remote control of the UH 2.2m and SNIFS is done through VNC, allowing control to be shared by multiple users and monitored by non-interacting users.



VNC and chat interfaces. For normal observing a text chat is used to communicate between observers at different locations. "Crow" is a chatbot which alerts observers to errors and current conditions and can answer various useful questions about the telescope, weather, and observations.

Since VNC viewers exist for nearly any current operating system (Linux, OS X, even Windows), SNfactory operations can be done from nearly any computer connected to the Internet. The connection from the outside world to the summit has only been lost twice in SNIFS operations, once due to a storm which also precluded observations (and the connection was still available to the UH TO in Hilo), and once due to a helicopter crash landing on the lines (although the connection was restored within hours). As of Sept 2004 all SNIFS observations are scheduled and scripted before the night and executed by the Automated Instrument Control (AIC) program, such that on a night with good weather the SNfactory operator may only type a single command, and otherwise simply monitor operations.

Below and right: preliminary reductions of SNIFS spectra for three additional SNe Ia near maximum light. The SNfactory will advance the understanding of SNe Ia diversity by studying a wide variety of SNe Ia in great detail.



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For more information on the SNfactory, contact Brian Lee (BCLee@LBL.gov) or Greg Aldering (GAldering@LBL.gov) or visit our webpage at <http://snfactory.lbl.gov/>